

NATIONAL WEATHER SERVICE, LOUISVILLE

Spring/Summer 2005 Volume 6, Issue 1



Eye on the Sky

Louisville Welcomes New Meteorologist-in-Charge

by John Gordon

Hello, I'm John Gordon, the new Meteorologist-In-Charge (MIC) of the National Weather Service (NWS) office in Louisville. I'm thrilled to live in Derby City and serve the citizens across 59 counties in central Kentucky and southern and Indiana. I reported for duty on January 19 and have spent much time getting to know the media and Emergency Managers across the Blue Grass and Hoosier States.

I received a Bachelor of Science degree in Meteorology from Parks College of Saint Louis University in 1986 and a Masters in Teaching in Geoscience from Mississippi State University in 2002.

I spent six years in the U.S. Air Force where I served as an Airborne Warning and Control System (AWACS) E-3A wing

weather officer at Tinker Air Force Base in Oklahoma City from 1987 to 1990. Next, I was a Team Chief at the European Forecast Unit in Trarbach, Germany from 1990 to 1992, which included supporting Operations Desert Shield and Desert Storm. In 1993, I began my NWS career in Jackson, MS as a meteorologist intern. From 1994 to 1998, I worked as a forecaster in Springfield, MO before moving to the Nashville, TN office as a lead forecaster from 1998-2001. I then became the MIC in Huntsville, AL for two and half years.

In addition my NWS job, I'm a flight meteorologist for the U.S. Air Force Reserve Hurricane Hunters based in Biloxi, MS. I've been in the Hurricane Hunters since 1993, and flew 6 long missions into



Meteorologist-In-Charge at the National Weather Service in Louisville, John D. Gordon.

Hurricanes Frances and Ivan this past season.

My philosophy is based strongly on customer service and meeting the needs of our partners, including Emergency Management, media, law enforcement, and the scientific community. If you have questions, comments, or criticisms please email me at john.gordon@noaa.gov.

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Do You Have a Tornado Safety Plan:

- For your home?
- At work?
- If you're on the road?



Snow covering a car at Milltown, Indiana on December 23, 2004. Photo: Angela Crecilius

White Christmas

A ruler shows 2 feet of snow at Milltown, Indiana on December 23, 2004. Photo: Angela Crecilius





Seasonal Outlooks

by Ben Schott, Journeyman Forecaster

25 Years Ago (1980):

March 1-2: Coldest March high temperatures at Louisville, Lexington, and Bowling Green: 17°, 14°, and 21°, respectively.

June 7: F1 tornado in Harrison County, IN and two F1 tornadoes in Orange County.

June 10: An F0 tornado was spotted in Fayette County.

July 2: A major severe weather outbreak brought five F1 tornadoes (Boyle, Fayette, Mercer, Scott KY, and Woodford counties), three inch diameter hail (Bullitt and Oldham counties), and 100 mph winds (Hardin, Larue, and Hart counties) to the area.

July 16: Lexington hit 100°, Louisville 101°, and Bowling Green 107°.

July 17: 103° at Jamestown, KY (Russell County).

July 20: 106° at Cecilia, KY (Hardin County).

September 22: An F1 tornado struck Oldham County.

October 3: Louisville's earliest autumn snow on record (just a few flurries).

Here is a quick look at the upcoming seasonal outlooks issued by the Climate Prediction Center (CPC) in Washington (<http://www.cpc.ncep.noaa.gov/index.html>).

CPC uses long range weather modeling programs and tropical Pacific Ocean sea surface temperatures as some of the tools to predict seasonal averages over the United States. Sea surface temperatures and the effects of El Nino, La Nina, and other phenomena such as the Madden-Julian Oscillation can have a large impact on seasonal weather trends across the country.

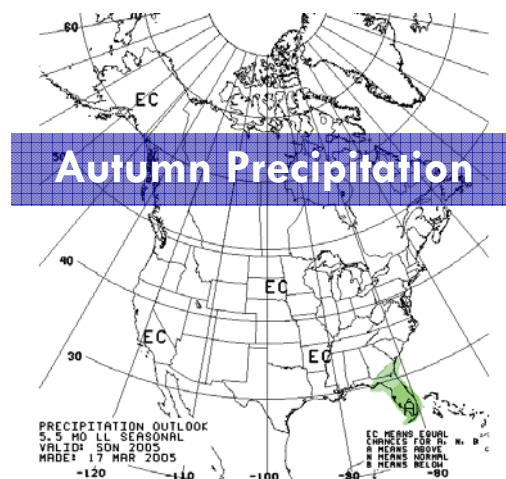
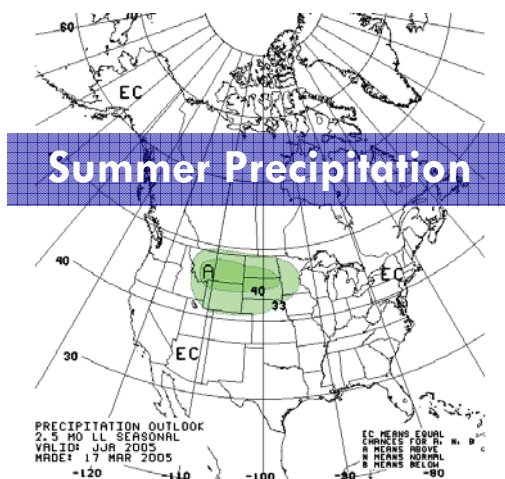
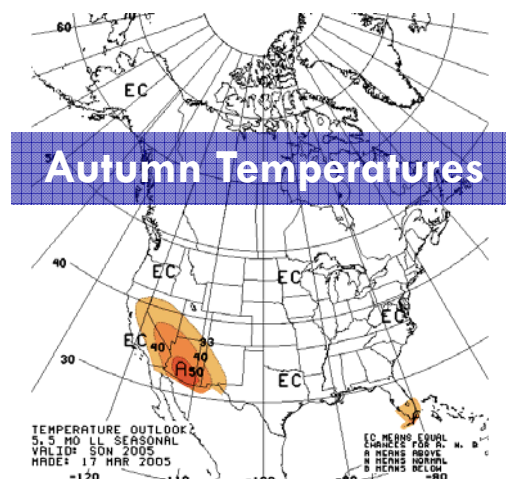
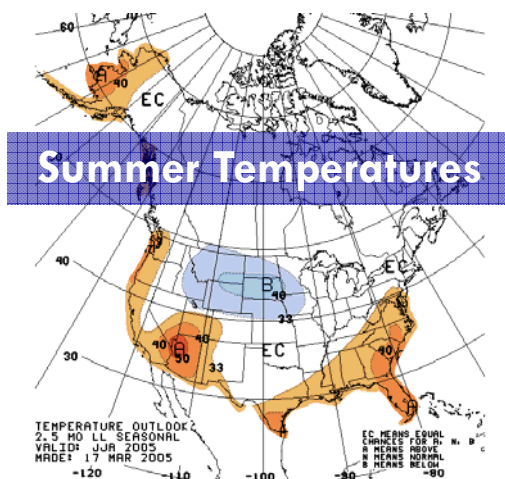
During this past fall and winter, we were in a weak El Nino pattern. However, CPC forecasts this pattern to fade to a neutral condition (neither El Nino nor La Nina) this spring and summer across the tropical Pacific Ocean.

Due to this expected neutrality, there is not enough of a signal to indicate how far away from normal this summer's and next fall's average temperatures and precipitation might be in our area.

However, tropical storm and hurricane activity is predicted to be above normal for late this summer and early fall. If any of

these storms strike the southeastern United States, this would bring much higher than forecast precipitation across that area. If any of these storms were to track into the Gulf of Mexico then north toward the Ohio Valley, then we would experience a wetter end to the warm season than suggested by the neutral El Nino/La Nina pattern.

Looking ahead, long term trends suggest next winter may be above normal for temperatures across the Ohio and Tennessee Valleys, but near normal for precipitation.

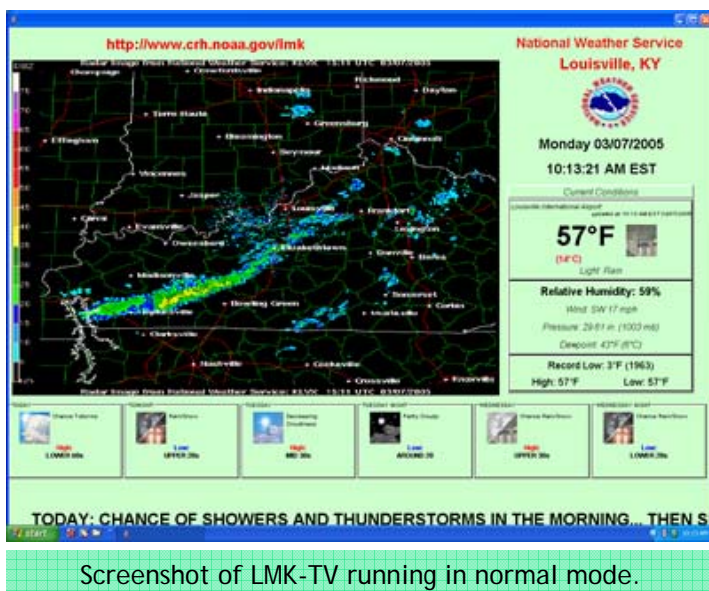


A classic shelf cloud ahead of a storm on July 6, 2004 in Adairville, Kentucky.

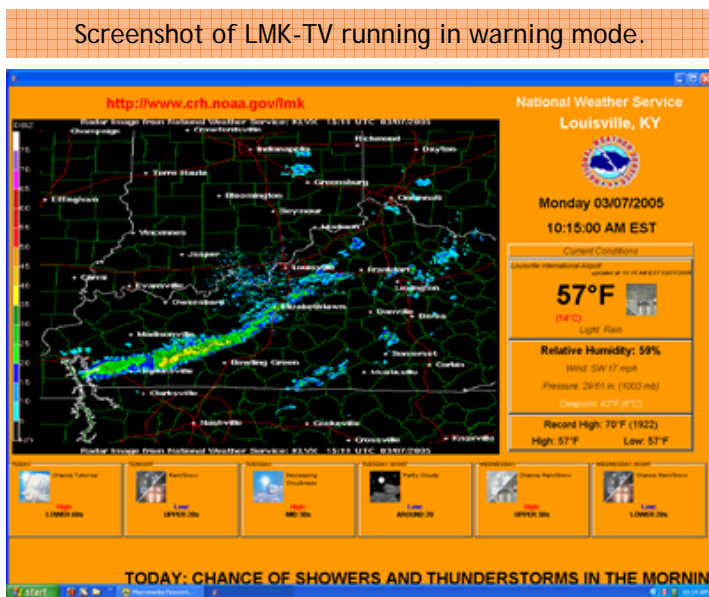
Photo: Dan Draper

LMK-TV

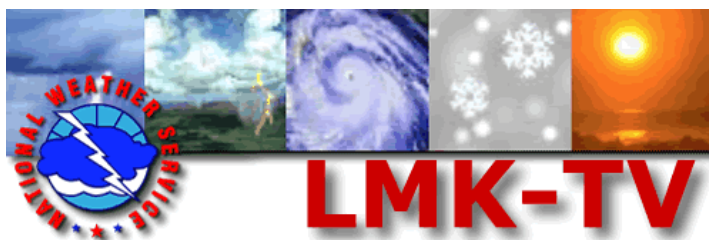
by Tony Freeman, Information Technology Officer



Screenshot of LMK-TV running in normal mode.



Screenshot of LMK-TV running in warning mode.



Send Us Your Weather Photos!

We have an on-line weather photo album at <http://www.crh.noaa.gov/lmk/nws-photo/index.php> and would very much like to add *your* photos to our collection! Older pictures of historical events are especially welcome. Visit our website for more information!

HUN-TV is a java-based application program developed by the Huntsville, Alabama Weather Forecast Office. HUN-TV is used to display forecasts, observational data, satellite, radar, and various warnings. HUN-TV is completely configurable.

LMK-TV is a preconfigured version of HUN-TV, customized for NWS Louisville's (LMK's) area of responsibility, which includes Lexington, Bowling Green, and southern Indiana. When a person installs LMK-TV, it will work "right out of the box" – no configuration required.

The application is a great way for emergency managers, schools, and the public to have a continuous snapshot of the weather throughout the area.

The application will operate in "normal" mode until a warning is issued for any part of NWS Louisville's area of responsibility. The background changes color when a warning is in effect and is a quick visual cue to the observer that there is something of importance happening in the area.

If you are interested in more information or would like to download LMK-TV for your use, visit our website at <http://www.crh.noaa.gov/lmk/lmkv/>.

50 Years Ago (1955):

March 4: An F3 tornado struck Madison County, Kentucky.

March 26: Louisville dropped to 12°, and Lexington and Bowling Green bottomed out at 14°.

April 24: Madison County was hit by another tornado...this one an F1.

75 Years Ago (1930):

May 7: An official weather office was established at Bowman Field in Louisville.

July 2: Kentucky's hottest temperature was recorded: 114° at Greensburg, Kentucky (Green County).

July 28: Probably Kentucky's overall hottest day on record. Afternoon highs included: Louisville 107°, Anchorage 111°, Berea 108°, Bowling Green 113°, Leitchfield 108°, Russellville 108°, Shelbyville 112°, Bardstown 112°, Franklin 111°, Greensburg 114°, and Taylorsville 108°. All of these readings are the hottest temperatures ever recorded at these sites.

October 12: Bowling Green's warmest October temperature: 94°.



Mobile home destroyed by a tornado in Hardinsburg, Kentucky on June 12, 2004.



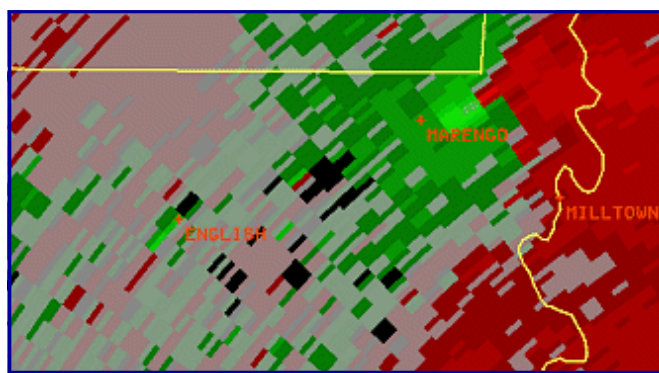
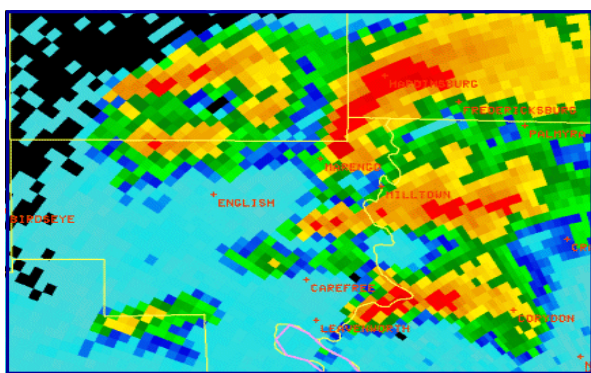
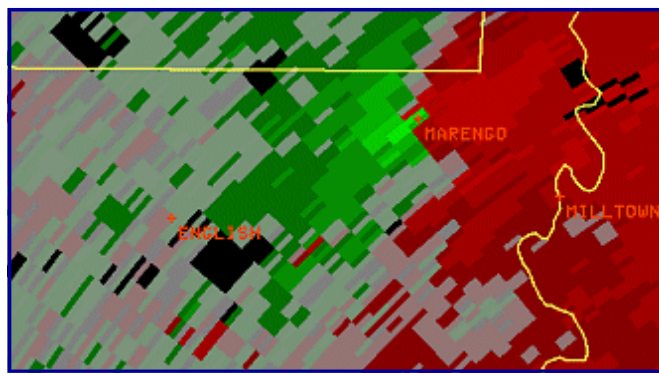
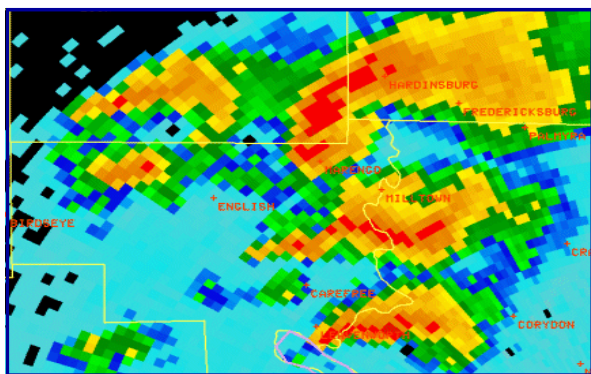
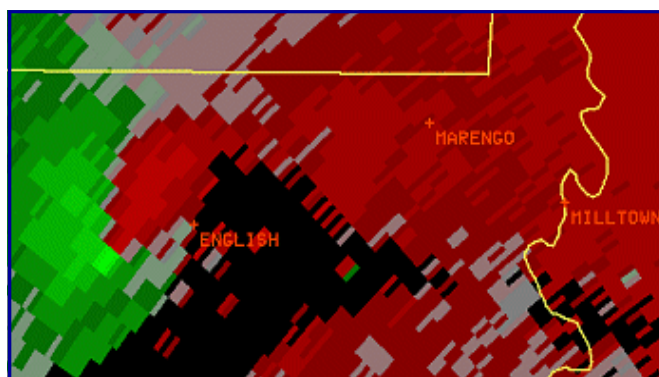
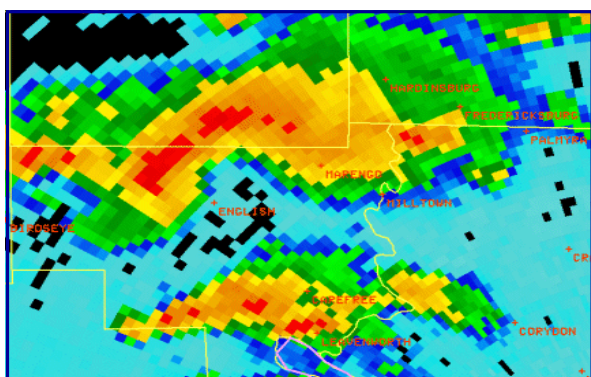
A Look at NWS Doppler Radar Imagery: Supercell

by Ted Funk, Science and Operations Officer

The 2004 severe weather season was quite active and lasted into the summer across central Kentucky and south-central Indiana. Various weather systems assembled the necessary weather elements to produce severe thunderstorms, which caused wind damage, large hail, and a few tornadoes. A variety of storm structures were noted, including supercells, squall lines, and bow echoes.

A supercell normally is a large severe storm occurring in a significantly vertically-sheared environment which contains a quasi-steady, strongly rotating updraft. The rotation in the storm is necessary, but not sufficient for tornadoes to form at the bottom of the storm. Supercell tornadoes form via complicated storm-scale processes which depend on the interaction of the storm's internal dy-

namical structure including its forward and rear flank gust fronts with the influx of buoyant, sheared air immediately around and under the rotating updraft (mesocyclone) within the storm. Recent theories suggest the temperature and moisture characteristics of the rear flank downdraft of a supercell are very important in spawning a tornado.



Images from the NWS Doppler radar on May 30, 2004. Reflectivity data (left) showed a large supercell over northern Crawford County, IN (top left) just northwest of English. The "hook echo" of the storm moved northeast over Marengo in subsequent images. At right, a series of corresponding storm-relative velocity images showed strong rotation within the storm, which spawned a damaging tornado in Marengo. Rotation is noted by the green/red couplet, evident west of English (top right), then immediately in Marengo (middle right), then just northeast of Marengo (bottom right).



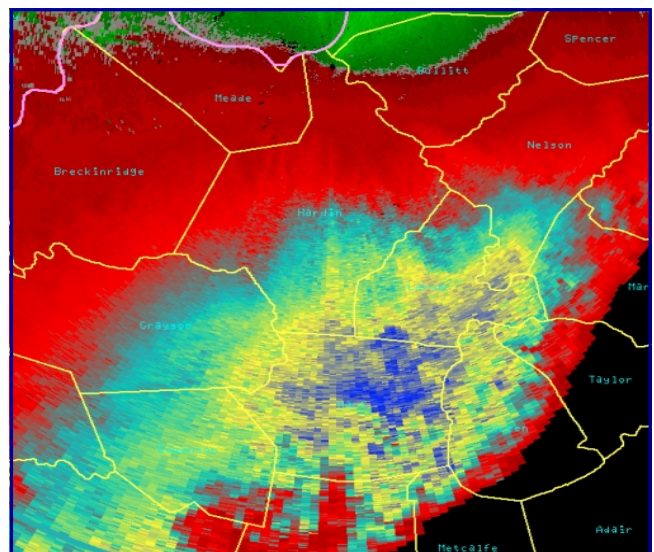
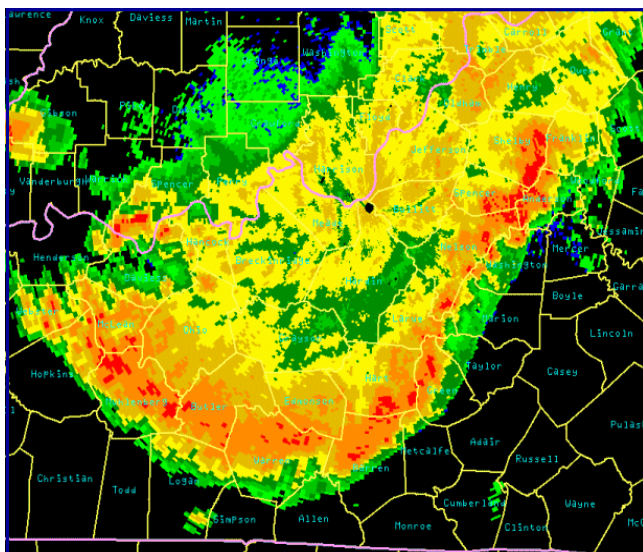
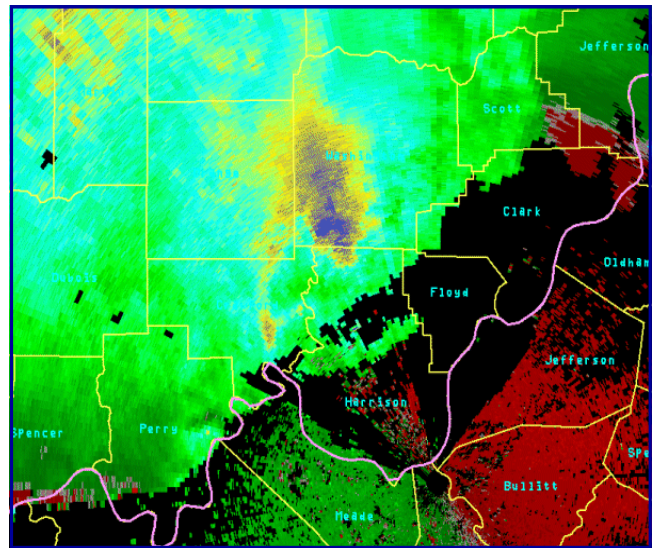
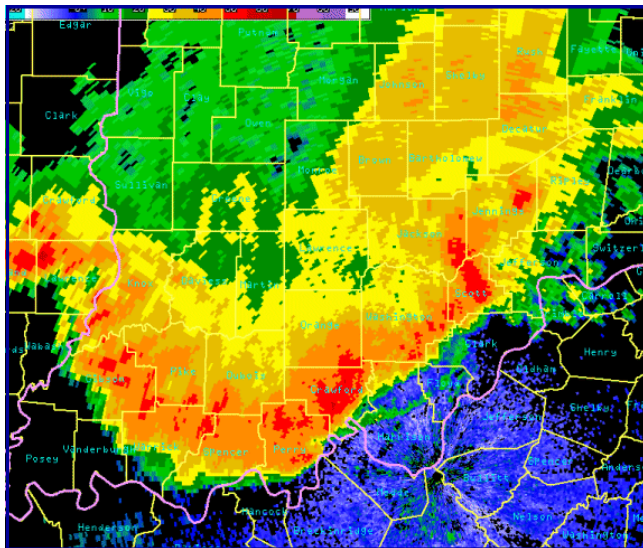
A Look at NWS Doppler Radar Imagery: Bow Echo

by Ted Funk, Science and Operations Officer

A squall line refers to a linearly-oriented zone of thunderstorms. Squall lines are common across the United States east of the Rockies, especially during the spring when the atmosphere is most "dynamic." A bow echo or bowing line segment is an arched/bowed out line of thunder-

storms, sometimes embedded within a squall line. Bow echoes usually are associated with an axis of enhanced winds that create straight-line wind damage at the surface. In fact, bow echo-induced winds/downbursts account for a large majority of the structural damage resulting from

convective non-tornadic winds. Transient tornadoes also can occur in squall lines, especially in association with bow echoes. These tornadoes, however, tend to be weaker and shorter-lived on average than those associated with supercell storms.



Series of images from the NWS Doppler radar on July 13, 2004. Reflectivity data (left) showed a well-defined, large-scale bow echo over southern Indiana (top left) which moved south rapidly into southern Kentucky (bottom left). Torrential rain and very strong winds (up to 80 mph) along the leading edge of the bow echo resulted in widespread straight-line wind damage across many counties. At right are the radar's corresponding storm-relative velocity images (using an alternate color scale). At top right, the greenish shades denoted winds advancing toward the radar (located at Ft. Knox, KY southwest of Louisville). Within this shading, dark blue colors represented radar-indicated winds of 80-90 kts just above the ground near the leading edge of the line of storms. These potent winds (dark blue) advanced southward into central and southern Kentucky (bottom right) embedded within an area of red color, which indicated winds directed away from the radar after the bow echo roared through the region. Despite the intense winds and wind damage, no tornadoes occurred with this event.



March 1960...Do You Recall?

by John Denman, Journeyman Forecaster



Major damage to an outbuilding in Clark County, Indiana on May 30, 2004.



Tornado damage in Henry County, Kentucky on May 27, 2004.



Mobile home tossed and flipped by a tornado May 27, 2004 in Washington County, Indiana.



Tornado damage in Mercer County May 11, 2003.

Spring certainly seemed to arrive late this year. Temperatures for the first two weeks of March 2005 averaged 5 to 8 degrees below normal. A couple of light snows even fell across northern Kentucky and southern Indiana. Compare this, however, with the record cold in March 1960. All of Kentucky and the Ohio River Valley suffered under temperatures which averaged 13 to 15 degrees below normal. Below is a table which shows the normal average temperatures for March, averages for March 1960, and averages for the second coldest March.

When comparing the top 5 coldest or warmest months on record, most

locations will only show a degree or two difference between each of the months being compared. Thus, for March 1960 to average 5 degrees colder than the second coldest March, the chill must have been extraordinary.

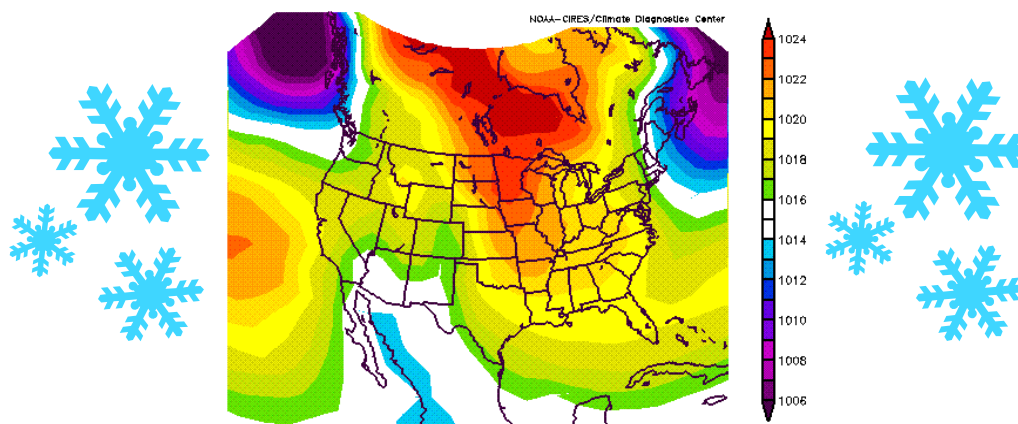
Record snowfall contributed to these freakishly cold temperatures. Louisville and Lexington received 22.9 and 17.8 inches of snow during March 1960, respectively, while Bowling Green had an incredible 32 inches! For Louisville and Bowling Green, March 1960 was the second and first snowiest month ever recorded, respectively.

Not surprisingly, the coldest daily temperatures

ever recorded for the month of March occurred in 1960. The -6°F recorded in Bowling Green on March 5 beat the second coldest temperature by 6 degrees! Louisville's -1°F temperature on the 6th also was the coldest March day on record. In Lexington, the -2°F measured on the 6th proved to be the second coldest day on record.

March 1960 set record cold temperatures all the way from Chicago to Tennessee. Repeated storms with heavy snow brought widespread damage and hardship across the Ohio and Tennessee Valleys. So, if you think March 2005 was cool, be glad it was not March 1960.

	Normal	March 1960	2nd Coldest March
Bowling Green	47.8°	32.6° (-15.2°)	37.8° (-10°, 1947)
Louisville	46.9°	32.5° (-14.4°)	37.1° (-9.8°, 1947)
Lexington	45.6°	29.7° (-15.9°)	34.8° (-10.8°, 1947)



This is a map of average sea level pressure for March 1960. The reds and yellows indicate high pressure. Over the course of the month strong high pressure systems plunged south out of Canada into the central and eastern United States, bringing frigid weather along with them after storms brought snowfall to the region.

The Data Bank

by Don Kirkpatrick, Senior Meteorologist

In this issue of The Data Bank, we compare the worst tornado disasters of the 20th Century and examine how recent dramatic gains in technology and meteorological knowledge have saved lives.

In 1925, television was years away, radio was just a few years old, and tornado forecasting was in its infancy. Weather watchers could not predict that a severe thunderstorm developing in southeastern Missouri on the afternoon of March 18 was about to grow into the deadliest twister in U.S. history.

The tornado formed around 1 pm and began moving northeastward. Two small towns were leveled, killing 8 people before the twister roared at 60 mph across the Mississippi River into Gorham, Illinois. At that point, the tornado's base was nearly a mile wide, lacking the traditional funnel shape which may have alerted residents of the storm's true nature. Nearly half of Gorham's 500 people were killed or injured.

The devastating tornado then drew a bead on the towns of Murphysboro, De Soto, and Parrish leaving nothing in its wake but foundations. As the huge vortex passed West Frankfort, Illinois, an astonishingly low surface pressure of 28.87 inches of mercury was recorded. The F-5 tornado then crossed the Wabash River into Indiana with a ground speed of 73 mph, twice as fast as the

average tornado. After destroying several more towns, the storm finally dissipated near Princeton, Indiana, making it the longest and fastest moving tornado in history.

The unusual path covered by this Tri-state tornado emphasizes the extraordinary nature of this storm. It stayed on the ground for three and a half hours and left a continuous path of destruction 219 miles long. With winds of more than 300 mph and an average ground speed of 62 mph, travelers caught in its path had no chance of outrunning the fast-moving tornado. The characteristics of this twister combined with a very limited warning system at that time led to the most lethal tornado in the U.S., with a death toll of 695 people.

Almost 50 years after the Tri-state storm, another outbreak of tornadoes would occur which proved the importance of early warning systems. In the early morning of April 3, 1974, meteorologists at the National Severe Storms Forecast Center (today known as the Storm Prediction Center) advised local National Weather Service offices in the Tennessee and Ohio Valleys that severe storms would spawn tornadoes that day. Over a span of 16 hours, 148 twisters churned across the east central U.S. from the northern Gulf States to the southern Great Lakes. This Super Outbreak was unprecedented in U.S. weather

chronicles. Six tornadoes grew into giant F-5 twist-ers, two of which hit Brandenburg, Kentucky and Xenia, Ohio.

The Brandenburg tornado, which virtually destroyed the town, claimed 31 lives and caused a significant fall and ensuing rise of the water level on the Ohio River as it crossed. The Xenia F-5 twister left 33 people dead in the wake of its rampage despite timely warnings from the National Weather Service and local media. Police took to the streets with loudspeakers, warning residents to take cover. Half the city was destroyed in 9 minutes including nine churches and over 1300 homes and businesses.

In all, the Super Outbreak claimed 330 lives in a wide swath from the lower Tennessee Valley to the upper Ohio Valley. But many more would have perished if not for the 28 severe weather watches and 150 tornado warnings issued by the National Weather Service. The death toll was less than half that of the Tri-state tornado, even though the affected area was much larger.

Twenty five years after the Super Outbreak (May 3, 1999), 76 tornadoes roared across parts of Oklahoma and Kansas, more than half of them in the Oklahoma City metro area. Early that day, meteorologists at the Storm



TORNADO WARNING!

What Do I Do??

- Go low: get in a storm cellar or basement
- Hide in the middle of the structure you're in — put as many walls between you and the tornado as possible
- Get under a sturdy piece of furniture
- Protect your head and body with a pillow or blanket
- Interior small bathrooms and closets can provide shelter
- Abandon mobile homes for sturdier shelter
- In open country lie flat in a ditch or ravine, or if possible, carefully drive away from the tornado at right angles to the storm's path
- Highway overpasses are usually not good hiding places

[Continued on Page 8...](#)



The Data Bank (continued from page 7)



Flood Safety

- Flash flood waves, moving at high speeds, can roll boulders, tear out trees, destroy buildings and bridges, and scour out new channels. Walls of water can reach heights of 10 to 20 feet, especially in mountainous locations
- When a Flash Flood Warning is issued for your area, act quickly — you may have only seconds to get to safety! Move to higher ground, if flood waters threaten
- Evacuate areas prone to flooding such as dips, low spots, and ravines.
- Never attempt to across a flooded stream
- Never drive through flooded stretches of road — you won't know the depth of the water nor the integrity of the underlying road surface
- Be particularly cautious at night
- Do not camp or park along streams or washes, especially during times of potentially heavy rain
- One inch of rainfall over one acre of land weighs 113 tons!

Prediction Center (SPC) issued a "High Risk" convective outlook, expecting a widespread outbreak of large tornadoes across the southern Plains. By late afternoon, a tornado watch was issued for much of Oklahoma as high resolution satellite imagery and modern Doppler radar showed the rapid growth of several supercells near Oklahoma City. Forecasters at SPC and the local National Weather Service forecast office knew that certain atmospheric parameters (foremost, strong vertical wind shear and a buoyant, very unstable air mass) were present to induce tornadic thunderstorms.

With this environmental knowledge, combined with early radar signatures of tornadoes and a well-trained spotter network, tornado warnings were issued well in advance of the first touchdowns.

Television stations picked up the warnings and began broadcasting across their coverage areas. Residents alerted by warning sirens and NOAA's All Hazards Weather Radio tuned in to watch the developing storms and to put their tornado safety plans into operation.

As an F-5 tornado ravaged parts of Oklahoma City, the National Weather Service and local media worked together to relay street by street reports of the twister's position. People heeded the warnings to get below ground or to the center of their homes for protection.

The Oklahoma/Kansas outbreak killed 48 people, most of those in Oklahoma City. Given that an F-5 tornado tore through an urban area, the death toll was greatly reduced by technological innovations, forecaster expertise, and frequent, specific commu-

nication which led to early and widespread watches, warnings, and safety information.

The National Weather Service modernization effort in the 1980s/90s was designed to provide meteorologists with a superior level of technology and training. This modernization effort has accelerated into the 21st Century with state-of-the-art technology and training applied toward tornado research. Fine-scale Doppler radars in Oklahoma have shown the internal structures of tornadoes indicating the inner funnel is not round, but contains distortions along the walls which may be caused by internal vortices.

In the future, storm researchers will continue to watch the birth and death of tornadoes, surrounding them with high-tech instruments to gain insight into this complex weather phenomenon.

Changes to Convective Watch Product Suite

The NWS has implemented changes to how it communicates severe weather watch information. This process, known as *Watch-By-County* (WBC), will help many users streamline automated software programs for the issuance and clearance of counties within a severe thunderstorm or tornado watch. New products were effective February 8, 2005, and the state local redefining statements (SLS

product) were discontinued on February 22, 2005.

The Storm Prediction Center (SPC) will issue Watch Outline Update (WOU) messages which will contain a comprehensive list of all counties and cities in all states contained in a watch. At this time, the WOU will be issued twice per watch: at the initial issuance time and again when the watch expires or is cancelled early. The WOU bulletin

from SPC replaces the state SLS bulletins previously issued by NWS Louisville and Indianapolis.

Local NWS offices will issue Special Weather Statements (SPS) to clear or cancel parts of a convective watch. Eventually (summer/fall 2005), NWS offices will begin issuing experimental Watch County Notification (WCN) messages for this purpose.

Area Climate Information

Average Temp. (Dep.) Precipitation (Dep.)	September 2004	October 2004	November 2004	Autumn 2004
Bowling Green	69.3° (-0.3°) 1.09" (-3.09")	61.8° (+3.9°) 5.69" (+2.52")	51.7° (+4.3°) 5.60" (+1.14)	60.9° (+2.6°) 12.38" (+0.57)
Lexington	68.3° (+0.3°) 3.22" (+0.11)	58.9° (+2.3°) 6.97 (+4.27)	49.2° (+3.3°) 7.32" (+3.88")	58.8° (+2.0°) 17.51" (+8.26")
Louisville	71.9° (+1.8°) 0.09" (-2.96")	61.4° (+2.9°) 7.33" (+4.54")	51.5° (+3.9°) 6.66" (+2.85")	61.6° (+2.9°) 14.08" (+4.43")

Average Temp. (Dep.) Precipitation (Dep.)	December 2004	January 2005	February 2005	Winter 04-05
Bowling Green	37.5° (-0.8°) 4.84" (-0.22)	41.3° (+7.1°) 4.77" (+0.62")	42.2° (+3.7°) 3.11" (-1.04")	40.3° (+3.3°) 12.72" (-0.64")
Lexington	36.1° (-0.2°) 3.38" (-0.65")	37.5° (+5.5°) 4.27" (+0.93)	39.6° (+3.2°) 2.23" (-1.04")	37.7° (+2.8°) 9.88" (-0.76")
Louisville	36.6° (-1.0°) 3.78" (+0.09)	38.4° (+5.4°) 5.07" (+1.79")	41.6° (+4.0°) 2.35" (-0.90")	38.9° (+2.8°) 11.20" (+0.98")

Normal Temperature Normal Precipitation	March	April	May	Spring
Bowling Green	47.8° 4.97"	56.8° 3.99"	65.8° 5.36"	56.8° 14.32"
Lexington	45.6° 4.41"	54.6° 3.67"	63.8° 4.78"	54.7° 12.86"
Louisville	46.9° 4.41"	56.4° 3.91"	65.8° 4.88"	56.4° 13.20"

Normal Temperature Normal Precipitation	June	July	August	Summer
Bowling Green	74.4° 4.29"	78.5° 4.54"	76.8° 3.36"	76.6° 12.19"
Lexington	72.2° 4.58"	76.1° 4.81"	74.8° 3.77"	74.4° 13.16"
Louisville	74.2° 3.76"	78.4° 4.30"	77.0° 3.41"	76.5° 11.47"